
Option 420 Supplement

to the

HP 5971A MSD Hardware Manual



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Introduction

This supplement describes Option 420 for the HP 5971A Mass Selective Detector MSD. Option 420 allows the HP 5971A MSD to be controlled from an HP G1030A MS ChemStation (DOS Series) Analytical Workstation.

Option 420 consists primarily of the following two printed circuit boards (cards) which replace an existing board in the MSD

- The HP-IB/MS Control Card (HP Part No. 05971-60006) replaces the GPIO board. This card provides a communication interface between the MSD and the data system. By buffering the data and providing real-time control of the MSD this card frees the data system for other activities.
- The APG Remote Control Interface (HP Part No. 05971-60009) mounts on top of the HP-IB/MS control card. This card provides a means for a remote-start signal to be sensed by the HP-IB/MS control card.

Refer to the block diagram in Figure 1 to see how these cards fit functionally into the system hardware. Figure 2 shows their physical location in the HP 5971A MSD

To accommodate the addition of these cards, two connectors are added to the MSD back panel, and several additional cable assemblies are provided. These changes are described in the next section.

Functional Description

HP-IB/MS Control Card	The HP-IB/MS Control Card (HP Part No. 05971-60006) is a Motorola 68000-based mass spectrometer controller and data buffer. Its primary functions are to provide data buffering and to assist the data system in controlling the instrument.
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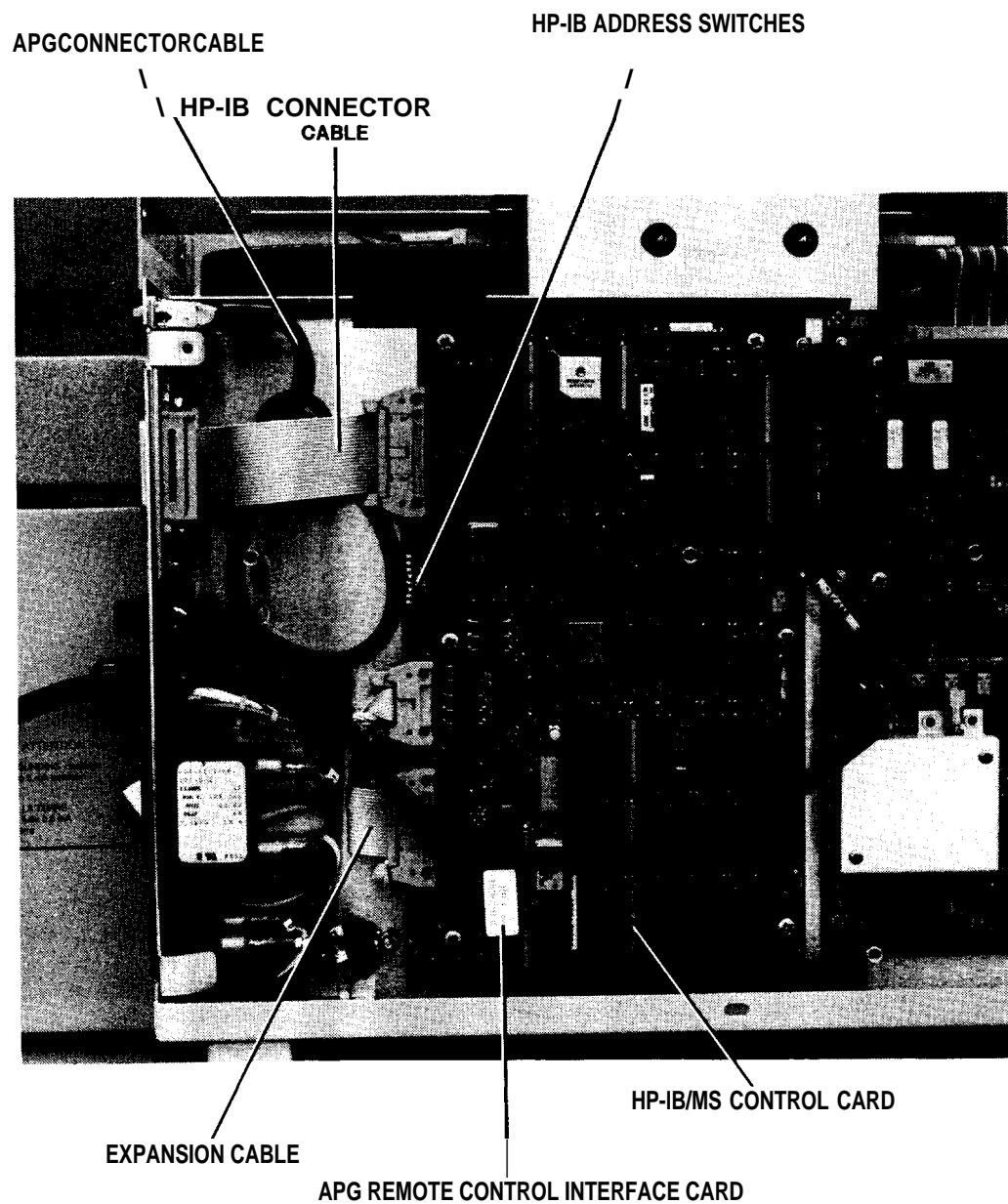


Figure 2. Card and Component Locations

The principal features and functions of the HP-IB/MS control card include:

- A 10 MHz system clock
- . One megabyte of RAM (for data buffering and code)
- 64K bytes of EPROM (for diagnostics and powerup initialization)
- Three 16-bit counters that are chained into one 48-bit counter for retention time
- Ž A two-channel DMA controller
- A 16-bit parallel interface to communicate with the mass spectrometer circuits
- Ž An interface to the Analytical Products Group APG remote bus on the remote control interface card
- An HP-IB interface for communication with the data system.

In the discussion of the functional areas that follows, refer to the HP-IB/MS control card block diagram shown in Figure 3.

68000 CPU

This device is the central processor that collects mass spectral data, performs data reduction, provides error checking, and communicates with the host data system. The 68000 CPU operates at a frequency of 10 MHz.

68440 DMA

This device moves data via the HP-IB interface from the data system to memory and from memory back to the data system. The MC68440 is a dual channel DMA controller with one channel hardwired to the HP-IB interface to allow efficient HP-IB transfers.

1 Mbyte RAM

The RAM on this card is comprised of eight 1-megabit dynamic RAMs (DRAMs). This provides a total of one megabyte of RAM for data buffering, stack space, and downloaded code.

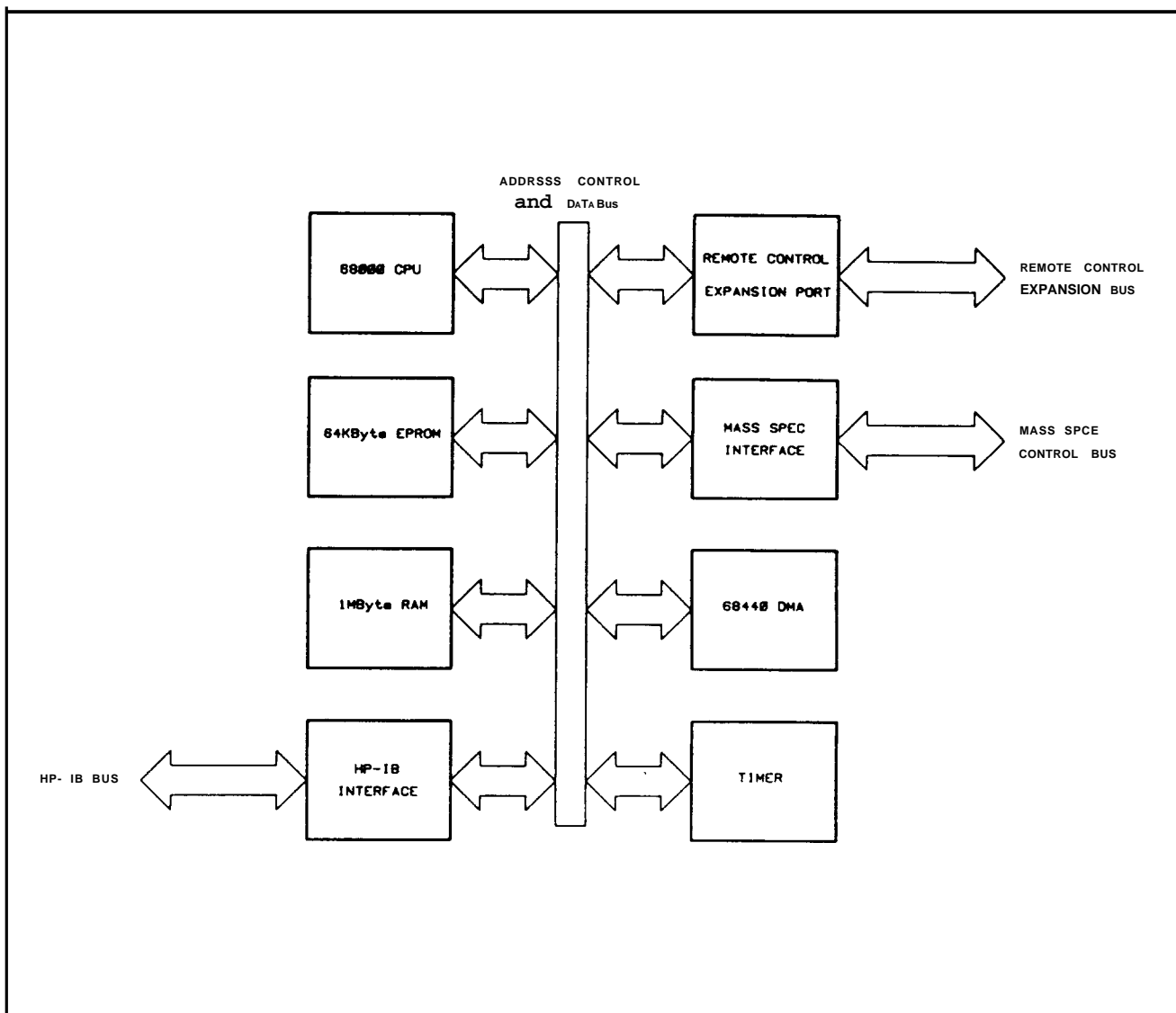


Figure 3. HP-IB/MS Control Card Block Diagram

64 Kbyte EPROM

The EPROM provides 64K bytes of nonvolatile memory for the HP-iB/MS control card powerup initialization. Upon powerup, this card initializes and performs an integrity test of its various subsystems. The results are available to the data system via serial poll

HP-IB Interface

This is the interface to the data system. The HP-IB interface controller is hardwired to the 68440 DMA controller for efficient data transfer.

HP-IB/MS address switch settings should be as shown in Figure 4 (address 20). See Figure 2 presented earlier in this section for the location of this switch on the HP-IB/MS control card.

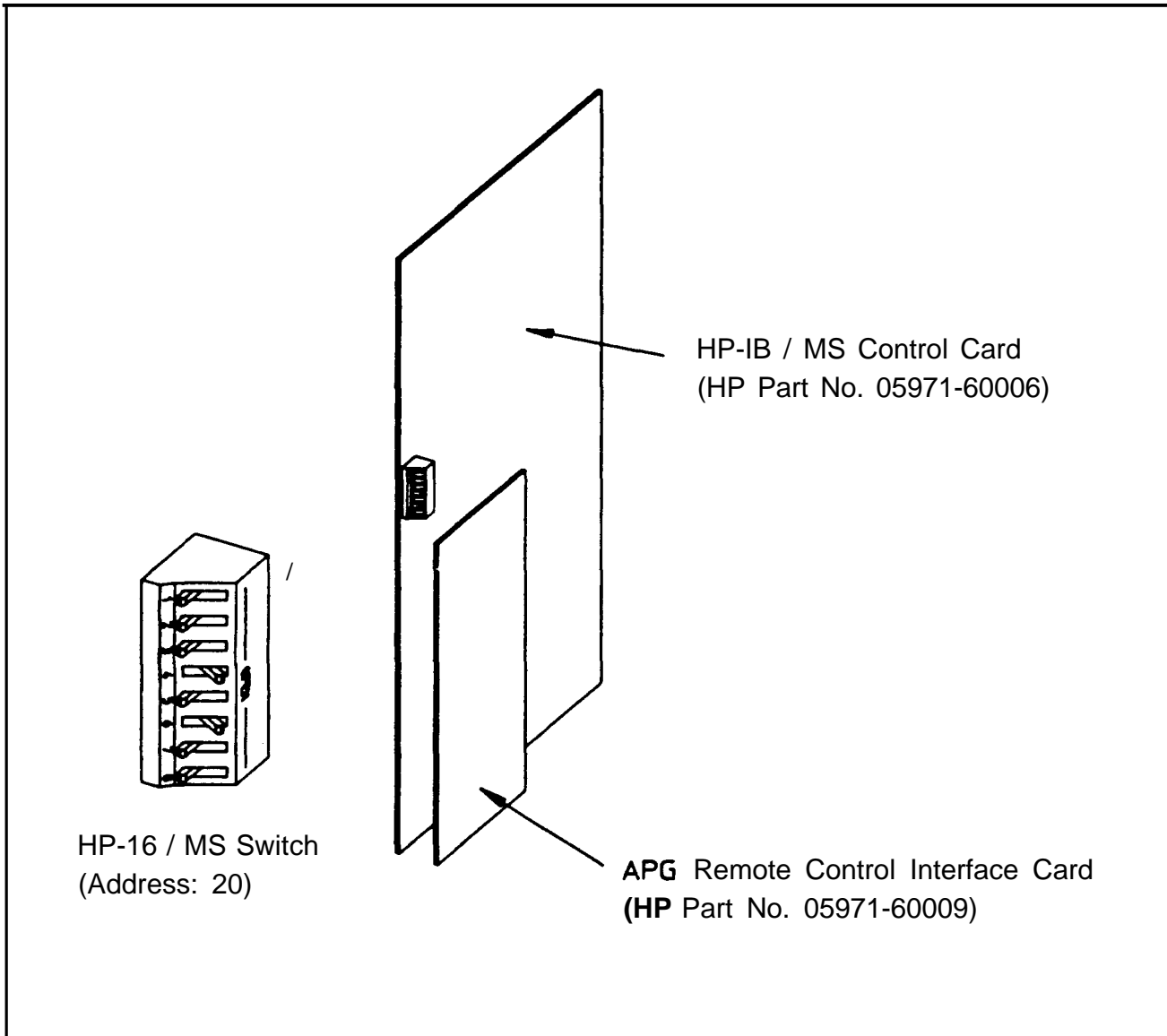


Figure 4. HP-IB/MS Address Switch Settings

Remote Control Expansion Port

This is an expansion port specifically to provide access to the APG remote control interface located on the APG remote control interface card (HP Part No. 05971-60009),

Mass Spectrometer Interface

The mass spectrometer input/output, or MSIO, is primarily a 16-bit input latch clocked by the rising edge of DCL*, and a 16-bit output latch with open collector drivers. DCL* is the device control line signal used to trigger reads and writes of data to and from the MSD

Timer

The MC6640 programmable timer is used to measure retention time, the period of time from injection to the occurrence of chromatographic peak. The timer can measure events up to 22.5 days with a resolution of 1 microsecond,

APG Remote Control Card The APG Remote Control Interface Card (HP Part No. 05970-60009) is mounted on top of the HP-IB/MS control card in the MSD. It is connected to the HP 5690 GC by the APG connector cable and the remote control cable. It is connected to the HP-IB/MS control card by the expansion cable.

The APG remote control interface provides a means for a remote-start signal to be read by the HP-IB/MS control card. It also ensures accurate run-start synchronization.

The design of the APG remote control interface is broken into four functional blocks:

- . Interface buffer
- . APG processor
- . APG bus interface
- . Relay and driver

You may wish to refer to the APG remote control interface block diagram during the following discussion of each circuit (see Figure 5)

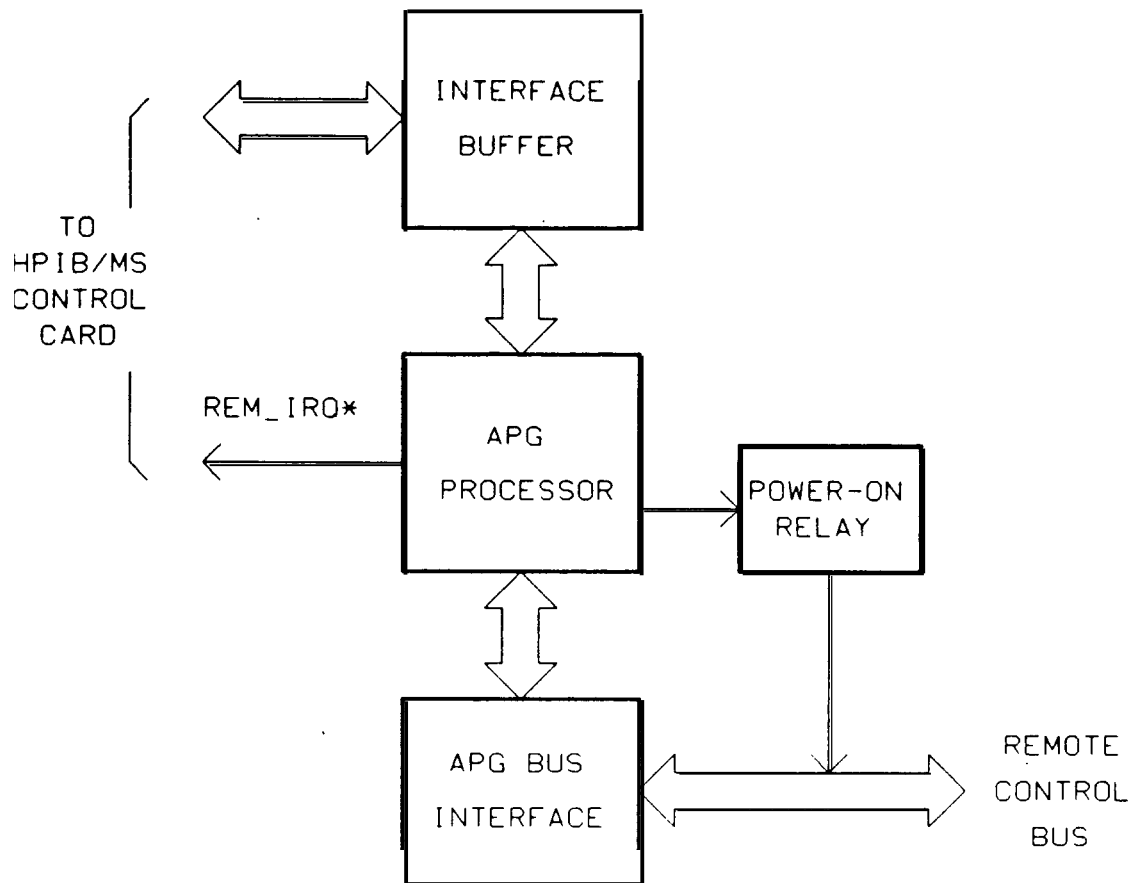


Figure 5. APG Remote Control Interface Card Block Diagram

Interface Buffer

This block buffers the connections between the APG remote control interface card and HP-IB/MS control card, and it protects the MOS microprocessor from electrostatic discharge (ESD). It contains address decode and data bus drivers to move data from the APG remote control interface card to and from the HP-IB/MS control card.

APG Processor

This block contains an HP 68701 microprocessor that forms the heart of the APG remote control interface card. It communicates with the HP-IB/MS control card by accepting commands and by providing data when asked. It also debounces the remote control bus and it provides the HP-IB/MS control card with an indication of important bus activity via the REM-IRQ* (REMOte Interrupt ReQuest) line. All conditions determining when interrupts occur and other configuration information are determined by the HP-IB/MS control card via commands to the HP 68701. Also contained in this block is the clock oscillator for the card.

APG Bus Interface

The APG bus interface drives and monitors the state of these APG bus lines. Contained in this block are ESD protection diodes, an 8-bit bus driver, and an 8-bit receiver. All of the power-up/down, de-glitch and loading requirements for the APG remote control bus are provided by this block as well.

Power-On Relay

This block contains the power-on relay and the power boost transistor to drive it. This relay is a normally closed type and is connected to the POWER-ON signal on the APG remote control bus. In this way, when the APG remote control interface card is powered-down, the POWER-ON signal is pulled to ground,

Rear Panel Connectors

The following two connectors (see Figure 6) are located on the MSD rear panel.

HP-IB Connector

This is the connector for the HP-IB cable. The HP-IB cable connects the MSD to the HP ChemStation. The connector is part of the HP-IB Connector Cable (HP Part No, 05971-60417).

APG Remote Connector

This is the connector for the remote control cable. The remote control cable connects the MSD to the HP 5890A Gas Chromatograph. The connector is part of the APG Connector Cable (HP Part No. 05970-60151).

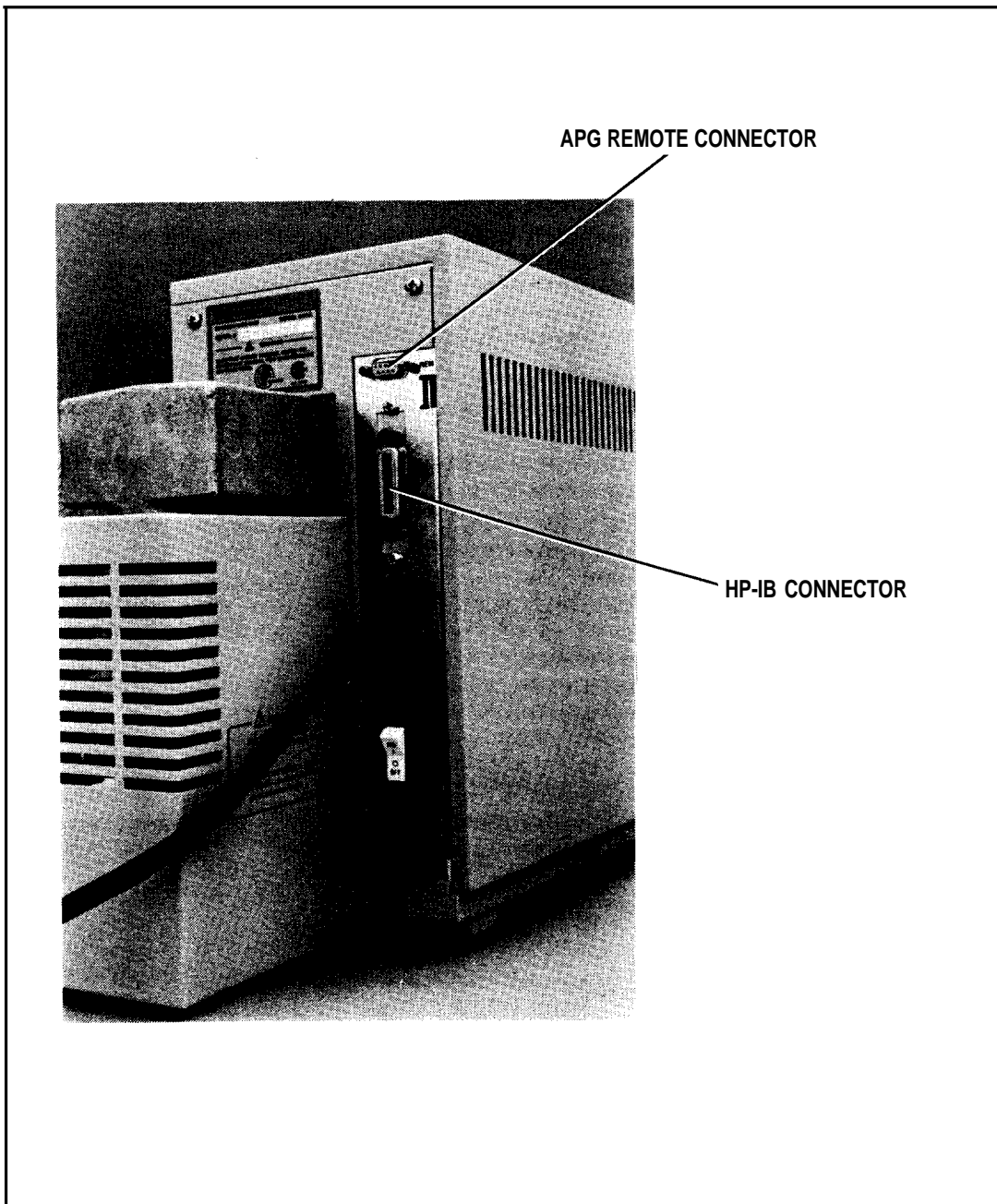


Figure 6. MSD Rear Panel

Cables The following cable assemblies have been added to implement Option 420. Turn back to Figure 2 for the locations of some of these cables.

HP-IB Cable

This one-meter cable connects the MSD to the data system. The cable part number is 8120-4654. Longer HP-IB cables can be used, but only if the accessory connector on the rear panel of the MSD is not being used. The longer HP-IB cables have right-angle connectors that cause the cables to cover the accessory connector. If you are not using the rear panel accessory control connector, you may wish to order one of the following HP-IB cables:

HP 10833B (2-meter length)
HP 10833C (4-meter length)

HP-IB Connector Cable

This cable connects the HP-IB/MS control card to the HP-IB connector on the instrument back panel. The cable part number is 05971-60417.

Remote Control Cable

This cable connects the MSD to the GC. The cable part number is 35900-60700.

APG Connector Cable

This cable connects the **APG** remote control interface card to the APG remote connector on the instrument back panel. The cable part number is 05970-60151.

Expansion Cable

This cable connects the APG remote control interface card to the HP-IB/MS control card. The cable part number is 05971-60426.

Parallel/Remote Cable

This cable, in conjunction with the parallel/remote printed circuit board (HP Part No. 05990430320), expands the HP 5890 GC remote connector to support the MSD and two additional devices in parallel (purge/trap and head space). This cable is not needed if only the MSD is connected to the GC. The cable part number is 05990-60019.

Interfacing External Devices

Often it is necessary to communicate with external devices, such as a purge and trap, during a run. Typically, there are three kinds of requests in this area:

- Send a 'System Ready' signal to an external device
- Receive a "Start Run" signal from an external device
- Program the timing of events during a run

System Ready

When interfacing to devices such as a Tekmar purge and trap, it is desirable to indicate a 'System Ready' to the external device. In the case of a multi-sample Tekmar, each sample is purged onto a trap and then waits for a ready signal. On receipt of this signal, the desorb cycle begins and the Tekmar gives a contact closure to indicate "Start Run" when a specific temperature has been reached. So the problem becomes, where to get the System Ready signal. The most obvious choice is the GC. Unfortunately, in most cases this only means the GC is ready, not the entire system.

GC/MSD systems with DOS-Series MS ChemStations follow the APG protocol for System Ready and Start Run. Thus, pin 5 on the APG remote connector on the HP 5890 GC main board is held "low" at all times except when the GC, MSD and data system are all ready for the next run. On System Ready, a logic "high" of 5 VDC is present between pin 5 and any ground (pins 2, 4, 5, 7 or 11). This same "high" can be detected between pins 7 and 1 on the APG remote connector on the rear panel of the MSD if no HP 5890A is present (see Figure 7).

HP 5971A MSD

HP 5890A GC

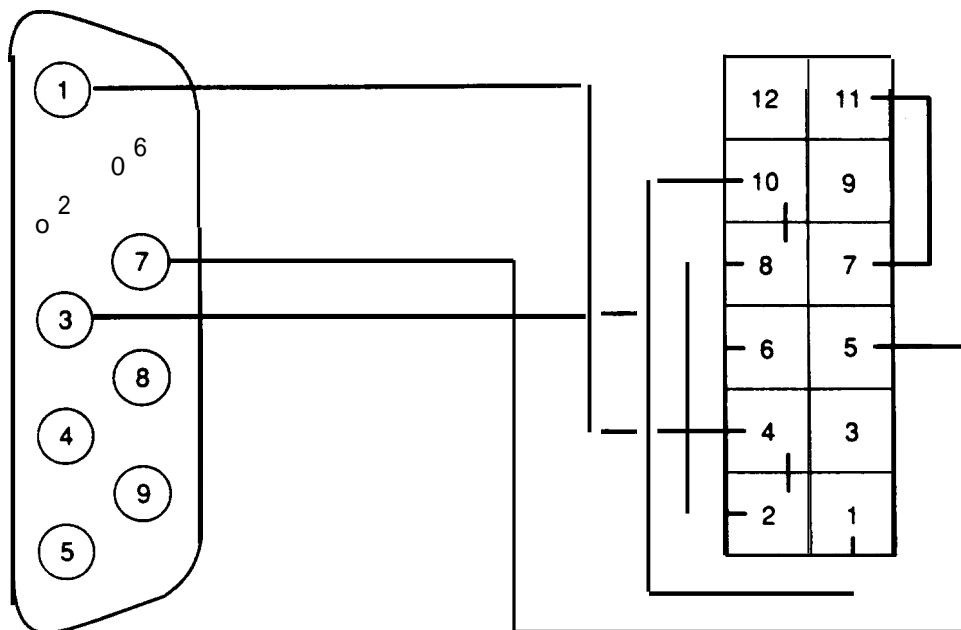


Figure 7. HP 5890A GC to HP 5971A MSD APG Remote Control Cabling

A Parallel/Remote Printed Circuit Board (HP Part No. 05990-60320) is included with Option 420. This small printed circuit board is connected by a short cable to the APG remote connector on the HP 5890 GC (see Figure 8). It allows up to three devices instead of one to be connected to the APG remote connector of the GC.

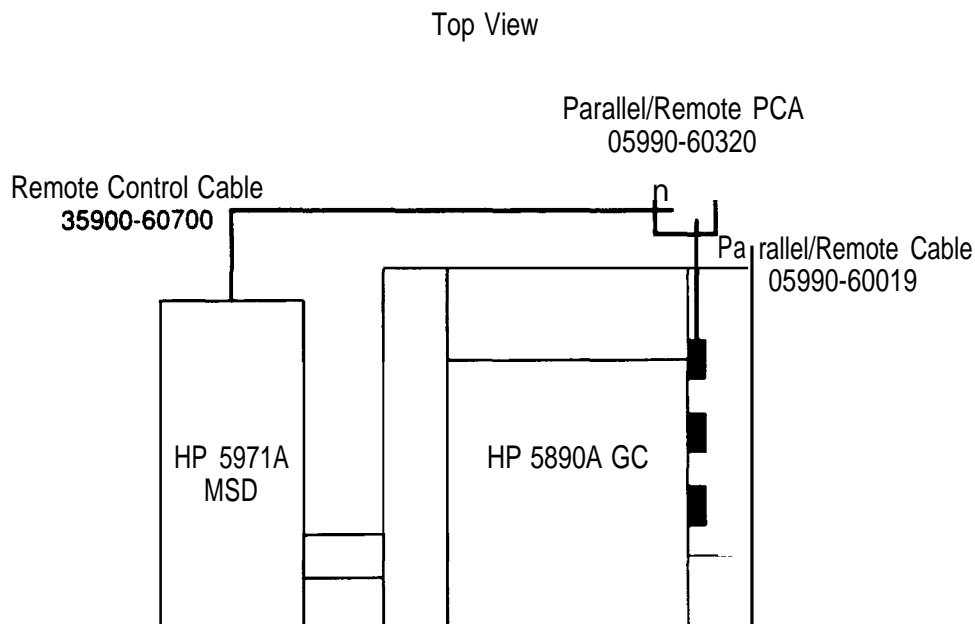


Figure 8. Parallel/Remote Board Cabling

Start Run Input On GC/MSD systems with DOS-Series MS ChemStations, the Start Run signal can be sent through the APG remote connector (pins 1 and 2) of the HP 5890A. Since remote cables are made for most common devices, this is often the simplest way. A general purpose remote cable (HP Part No. 05890-61080) is also available, which terminates in spade lugs. Care must be taken to ensure the system is, in fact, "Ready" before the Start Run signal is sent.

The best way to generate a Start Run signal is to use the APG remote connector mentioned above. Since the HP 5971A MSD (Option 420) follows the APG protocol for remote control, it is also possible to take advantage of the APG remote connector on the back of the MSD. A contact closure between pins 3 and 1 will start the run (again presuming the system is ready).

Troubleshooting

This section contains information to help you isolate the cause of communication problems in your GC/MS system. Throughout this section, 'MS Interface' and 'HP-IB/MS control card' are used interchangeably.

Prior to performing any of the troubleshooting tests listed in this section, the following steps should be taken.

1. Verify the HP-IB addresses of the MSD (20), GC (15), and ALS (8). Refer to Figures 9, 10, and 11, respectively, for the locations and settings of the HP-IB address switches.
2. Look for loose HP-IB connections.
3. Make sure the HP-IB interface cable is present on the GC.
4. Verify the GC has memory Revision G (or later).
5. Check that only the GC, MSD and ALS are connected to the HP-IB interface bus.
6. If the above steps do not correct the problem, switch all instruments on the HP-IB bus off and then back on.

Note If you need more information about testing the HP-IB bus, refer to the *HP 19257A HP-IB/MS-232 Interface Kit Installation and Setup Manual*.

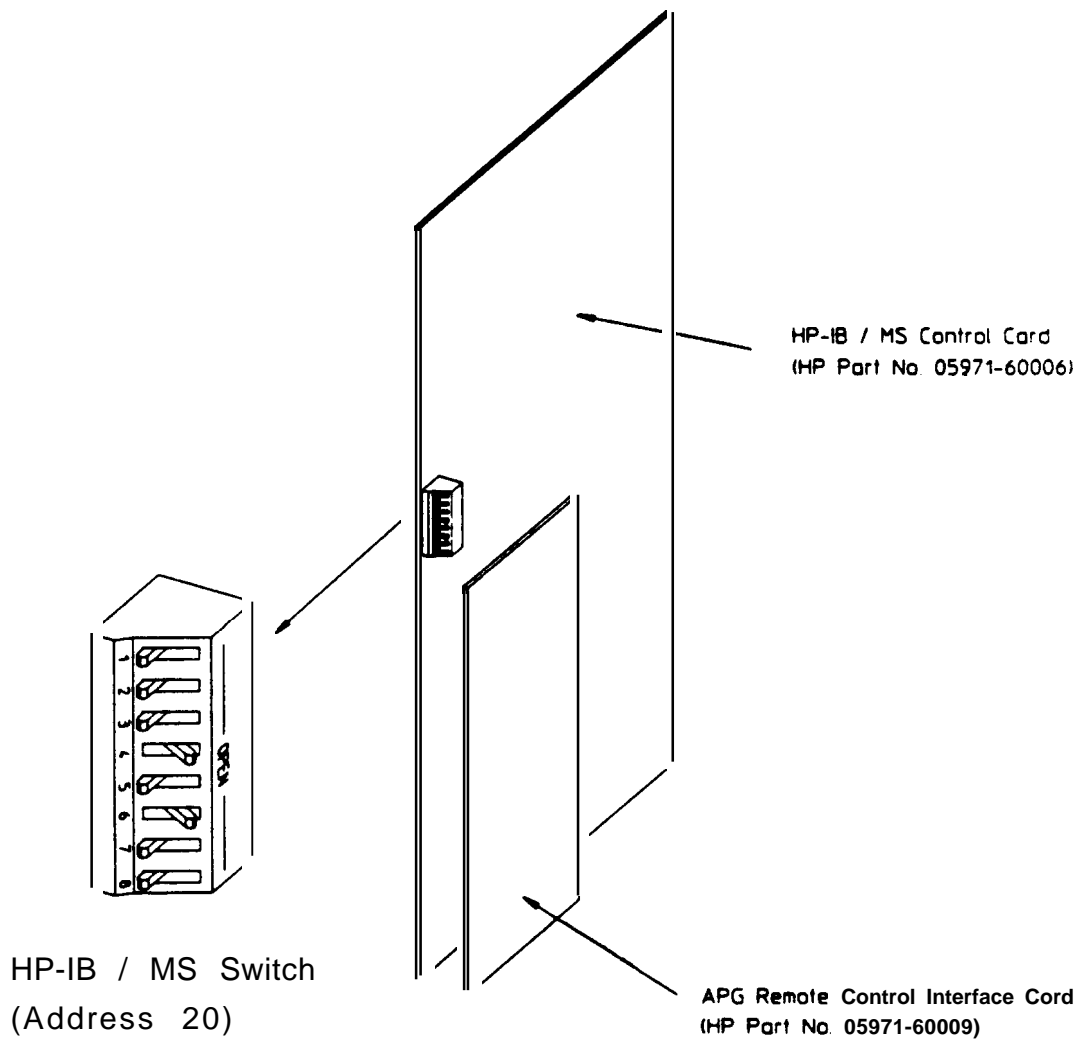


Figure 9. HP-IB/MS Control Card Switch Settings

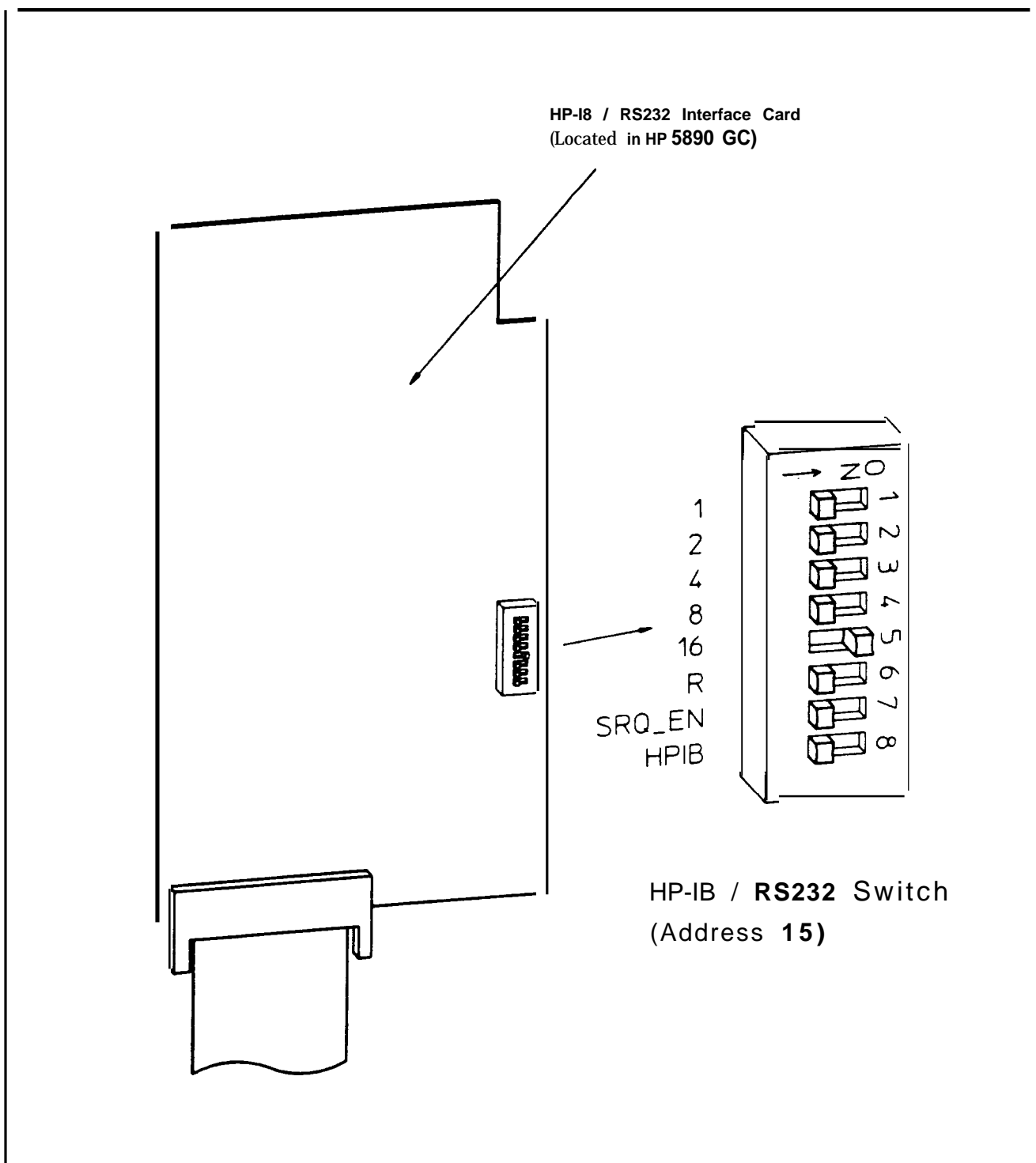


Figure 10. HP-IB/RS 232 Interface Switch Settings for HP 5890 GC

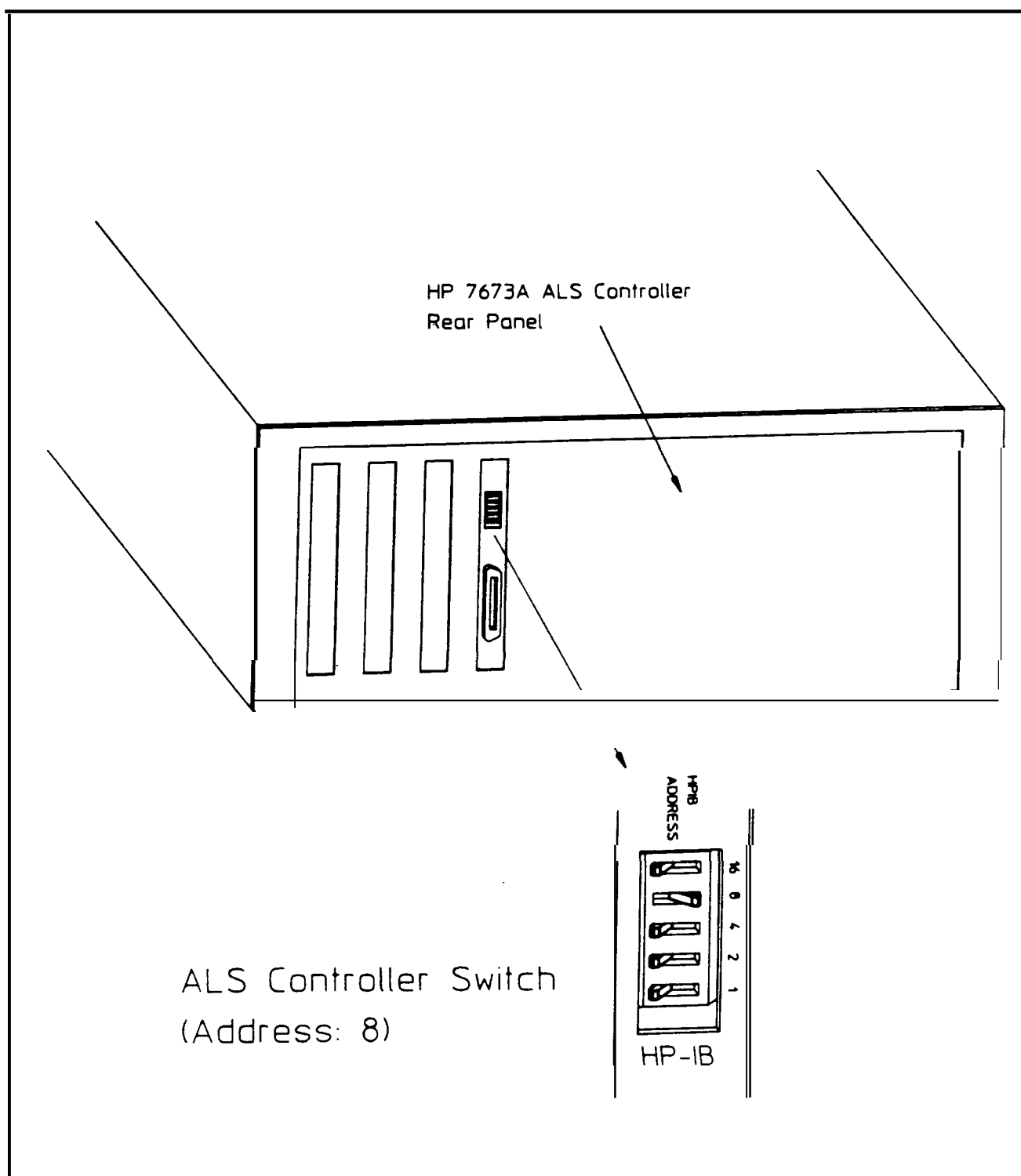


Figure 11. ALS Controller Switch Settings

HP-IB/MS Control Card Test

If you see a message such as “The MS Interface is not responding”, you could have a problem with either the HP-IB/MS control card, the GC, the ALS, the cables, or the MSD

To determine the location of the problem, proceed as follows:

1. Make sure the MSD has power; i.e., it is plugged in, turned on, and that the +5V test point on the main board reads between +4.75 and +5.15 VDC. Refer to the *HP 5971A MSD Hardware Manual* for more information about testing this voltage.
2. Ensure that the HP-IB/MS control card is plugged in and cabled correctly. Check both the HP-16 connector cable and external HP-IB cable.
3. Bring up the Manual Tune program via the TuneMS menu.
4. Turn the MSD off, and then back on, using the switch on the back panel of the instrument.

Caution

The system should not be power-cycled if the diffusion pump is warm; i.e., the air venting from the rear of the instrument is warmer than ambient. If the diffusion pump is warm, disconnect the foreline gauge connector, wait 10 minutes, reconnect the connector, and then power-cycle the instrument.

5. Try to initialize the HP-IB/MS control card by typing the command `scinit`.
6. If the HP-IB/MS control card is still ‘not responding’, disconnect the GC and ALS HP-IB cables (if present). Be sure there are no HP-IB devices on the HP-IB loop except the data system and the MSD. Power-cycle the MSD and re-initialize with the `scinit` command.
7. If the message ‘MS Interface initialized’ appears (takes 5-10 seconds), then the HP-IB/MS control card is probably OK and the problem could be with the GC or ALS. Follow the procedure for the GC/ALS test to determine whether the problem is with the GC or the ALS.

8. If the HP-IB/MS control card is still not responding, replace the internal MSD HP-IB Cable Assembly (HP Part No. 05971-60417), turn the MSD off, then back on, and re-initialize using `scinit`.
9. If the HP-IB/MS control is still not responding, replace the external HP-IB Cable (HP Part No. 8120-3446), power-cycle the MSD and re-initialize using `scinit`.
10. If the HP-IB/MS control card still does not respond, replace it with a rebuilt HP-IB/MS Control Card (HP Part No. 05971-69006),

Data Test To verify that the HP-IB/MS control card and the MSD are providing data, proceed as follows:

1. Bring up the Manual Tune program via the Tune MS menu
2. Turn the MSD off, then back on, and re-initialize the HP-IB/MS control card with the command `scinit`. Repeat this power-cycle and initialization process several times and be sure that after each one, you see the message "MS Interface initialized". Each reset and download requires about 5 to 10 seconds.

GC/ALS Test

This procedure assumes that you have successfully completed the first seven steps of the HP-IB/MS control card test and have determined that the HP-IB/MS control card operates correctly when the GC and ALS are disconnected, but fails if they are connected.

To determine if the problem is associated with the GC or the ALS, proceed as follows:

1. Reconnect the GC to the HP-IB bus but leave the ALS disconnected.
2. Bring up the Manual Tune program via the Tune MS menu.
3. Turn the MSD off, then back on, and re-initialize the HP-IB/MS control card with the command `scinit`.
4. If the message "MS Interface initialized" appears (takes 5 to 10 seconds), then the HP-IB/MS control card and the GC are probably OK and the problem could be with the ALS.
5. To verify this, reconnect the ALS, power-cycle both the GC and the MSD and re-initialize with the `scinit` command. If the HP-IB/MS control card fails to initialize, there may be a problem with the ALS,

Parts

This section contains the component listings for Option 420 to the HP 5971A Mass selective Detectpr. Consult the HP 5971A Mass Selective Detector Hardware Manual for ordering information.

Table 1. Parts

Description	HP Part Number
HP-IB/MS Control Card (rebuilt)	05971-69006
Parallel/Remote Cable (GC)	05990-60019
Expansion Cable	05971-60426
Parallel/Remote PCA (GC)	05990-60320
Remote Control Cable (to GC)	3590040700
HP-IB Connector Cable	05971-60417
APG Connector Cable	05970-60151
APG Remote Control Interface	05971-60009
HP-IB Adaptor Plate	05971-00580
HP-IB Cable	8120-4654



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